

Ted Shapiro, Geology 120 Lab, Metamorphic Report, due Oct 12

Section 1: Define what makes metamorphic rocks unique.

Metamorphic rocks are rocks that have been changed from one form to another, by heat, pressure, and or hydrothermal fluids. The parent rock may be igneous or sedimentary, but these processes change parent rock in known, predictable ways. Metamorphic rocks tend to lack pore space between the grains, which also tend to fuse together. Metamorphic rocks also may have an orderly crystal structure, unlike igneous rocks. They may also exhibit foliation, a process whereby minerals and grains are sorted, and flattened into parallel layers.

Metamorphic rocks also may exhibit folding. Metamorphic rocks that have been subjected to extreme heat and pressure may also have mineral ingots form within them, such as garnets or pyrite. Metamorphic rocks may be low grade, (subjected to moderate heat and pressure) High grade, (subjected to great heat and pressure) or intermediate (somewhere in between).

Section 2: Describe the major features.

Lineation: Lineation describes lines that appear in some types of metamorphic rocks. When viewed from the side, these lines may resemble layers, but if the rock is viewed end on, what appeared to be layers from the side, appear as points.

Foliation: Foliation is a process that sorts, aligns, and flattens, grains and minerals within a rock into parallel layers. This process is due to pressure, and heat. The layers align at right angles to

the direction of force. Grains become flattened and elongated. Foliation occurs when the protolith (parent rock) is high in the elements that make up platy minerals, such as micas; or is high in the minerals themselves. These minerals have a preferred crystal orientation, and during metamorphism, they are sorted, and align into layers. Mafic and felsic minerals tend to end up in separate, light and dark layers. Also, if the protolith contains grains that are inequant, these grains tend to rotate and form layers at right angles to the direction of force.

Non-Foliation: Non-foliation is the lack of foliation. This occurs when the protolith lacks the elements to form minerals with a preferred orientation such as mica. It also occurs when the grains or crystals of the protolith are equant (equidistant from the center to the surface, along any axis).

Shininess: Shininess occurs when a rock is high in shiny minerals such as biotite or muscovite. The mid-grade metamorphic rocks such as phyllite and schist, are shiny, due to the shiny minerals that they contain.

Garnetiferous: Some intermediate to high grade metamorphic rocks such as schists and gneiss may contain garnets. Garnets are a group of silicate minerals of various chemical compositions. They are hard, translucent, and often amber or red, although they have a wide range of colors. Garnets are considered to be semi-precious gemstones.

Section 3: the major metamorphic rocks. Metamorphic rocks are divided into two major groups, non-foliated and foliated. Foliated metamorphic rocks include slate, phyllite, schist, and gneiss. Non-foliated metamorphic rocks include marble, quartzite, and serpentinite.

Marble: Marble is a non-foliated metamorphic rock whose parent rock is limestone. The crystals are of nearly equal size and tightly fused. The rock is fairly soft and workable. Both the color and texture are quite variable. When polished, it appears shiny.



Quartzite: Quartzite is a non-foliated metamorphic rock whose parent rock is sandstone. Quartzite looks somewhat similar to its protolith, and has a sandpaper type texture, but the grains are fused together and will not rub off, as they will from sandstone. It is usually light colored.



Serpentinite: Serpentinite, is a non-foliated metamorphic rock that comes from ultramafic or mafic igneous rocks such as basalt and gabbro. It is soft, and crumbles easily. It is often a grey green color. It is toxic to most plants, and sometimes contains asbestos. The grains are not visible.



Foliated metamorphic rocks.

Slate: Slate is a foliated, low grade metamorphic rock, whose protolith is shale or mudstone. Slate is a dull grey, very fine grained, and can easily be split into flat sheets. It resembles shale, but when struck, it gives off a metallic sound, unlike shale, which gives off a dull sound.



Phyllite: Phyllite is an intermediate foliated metamorphic rock whose protolith is slate. It has a shiny, almost metallic luster, due to the presence of mica. It breaks along wavy foliation surfaces, rather than into flat sheets like slate.



Schist: Schists are a family of intermediate to high grade foliated metamorphic rocks, whose protolith is phyllite. It tends to be shiny, due to the presence of mica. It breaks along wavy, scaly, foliation lines. schists tend to be grey, or grey green, (green schist) or blue grey, (blueschist). Glaucophane or lawsonite give blueschist its bluish color. Schists may contain garnets.



Gneiss: Gneiss is a high grade foliated metamorphic rock, whose protolith may be schist, granite, or diorite. It is medium to coarse grained, and displays distinctive foliation bands of alternating light and dark layers.



Section 4: Thin section of a metamorphic rock.

Pictured At right is a thin section of schist. It shows the foliation lines, which occur in some metamorphic rocks. Here, mafic and felsic minerals are segregated into separate light and dark bands. Bending of the rock is also evident, something that only occurs when rock is hot and under directed pressure (shear). Interlocking of crystals is also visible.

